1987 Insect, Disease and Weed Pest Management Guide: COMMERCIAL APPLICATION FOR TREES AND SHRUBS

Commercial arborists, urban foresters and nurserymen find it necessary to control insects, diseases, and weeds at various times throughout the growing season in order to protect their investment and to preserve the aesthetic and social benefits of woody landscape plants.

This pest management guide has been prepared for use by Illinois commercial lawn and tree care personnel, municipal arborists, urban foresters, and nurserymen; it is not for homeowners or home gardeners. Furthermore, the commercial applicator is usually required to use a greater variety of pesticides and at higher rates in order to achieve effective control.

INTEGRATED PEST MANAGEMENT

A pest management program includes the wise and timely selection of cultural, mechanical, biological and chemical control measures to insure maximum effectiveness against the pest, and to minimize cost, and environmental effects.

In some cases, chemical control may not be necessary. Planting of resistant varieties and utilization of natural enemies or cultural methods may provide adequate control. In other cases, with high-value specimen plants, chemicals may be an integral part of the pest management program. Familiarization with the habits and life history of the pest will aid in these decisions.

CLASSIFICATION OF PESTICIDES

Pesticides are classified as either general-use or restricted-use by the U.S. Environmental Protection Agency. A person wishing to use a restricted-use pesticide must first be certified as a commercial pesticide applicator by the Illinois Department of Agriculture. Contact your local county Extension adviser for details of the certification program. Some of the products listed is this circular are restricted-use and others may become restricted-use in the near future. Therefore, check with your local county adviser if you are in doubt about the status of a particular pesticide. In some cases, decisions covering the present status of certain chemicals may be pending. Every effort will be made to keep you informed of any label changes or reclassifications via announcements in newsletters, the news media, grower meetings and pesticide training clinics.

PESTICIDE NAMES

The chemical names used in the tables may be unfamiliar to you. Pesticides have chemical, common, and trade names. A pesticide has only one common name but, may have several trade names depending on which company or companies market the product. To assist you in identifying a particular pesticide, common names and corresponding trade names are listed on the last page of this paper.

PROPER USE OF PESTICIDES

In using pesticides, be sure first to read the label and carefully follow label directions. Do not exceed the maximum rates suggested; observe carefully the proper timing for applying the pesticide and apply it only to plant material for which it is approved. Some chemicals may prove to be phytotoxic to certain plants so be sure to check the label. Keep a careful record of the product used, the trade name, the percent content of active ingredient of the pesticide, dilution, the rate of application, and dates of application for future reference.

This circular was prepared by Roscoe Randell and Fredric Miller, Extension entomologists, Malcolm Shurtleff, Extension plant pathologist, John Fech, Dave Williams, and Thomas Fermanian, Extension horticulturists.

UNIVERSITY OF ILLINOIS AT URBANA-CHAMPAIGN COLLEGE OF AGRICULTURE COOPERATIVE EXTENSION SERVICE
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PESTICIDE SAFETY

Remember, these chemicals are toxic and designed to kill the target organism. Also, be aware that hazard and toxicity are not the same! Hazard is a combination of toxicity and exposure. A chemical with low toxicity can still be hazardous if handled improperly. Some low toxic chemicals can cause blindness if splashed in the eyes, so be sure to wear the proper protective equipment as specified on the label. Other chemicals are highly toxic so proper handling and protective equipment is a must.

Pesticides can be an effective tool in controlling pests but they must be handled safely and effectively in order to achieve the desired results and at the same time keep human and environmental hazards to a minimum.

ADDITIONAL SOURCES OF INFORMATION

In the tables, leaflets describing the life history, biology, and habits of tree and shrub insect pests are indicated by the letters "NHE" and the leaflet number. These leaflets are available from your county Extension office or from Entomology Extension, 172 Natural Resources Bldg., 607 E. Peabody Drive, Champaign, IL 61820. The cost of each NHE leaflet is 15 cents. Checks should be made payable to the University of Illinois. Other pest management publications are available from the Office of Agricultural Publications, 54 Mumford Hall, 1301 W. Gregory Drive, Urbana, IL 61801. These include Circular Circular 900, *1987 Insect Pest Management Guide: Home, Yard, and Garden;* Circular 1260, *1987 Plant Disease Control Guide: Woody Ornamentals,* and *1987 Chemical Weed Control.*

The *Report on Plant Disease* (RPD) series, numbers 600 to 654, are available from Extension Plant Pathology, N-533 Turner Hall, 1102 South Goodwin Avenue, Urbana, IL 61801. The cost of each RPD is 25 cents. Checks should be made out to the University of Illinois.

GENERAL DISEASE CONTROL SUGGESTIONS FOR MOST WOODY ORNAMENTALS*

Diseases	Chemicals for control	Remarks
Damping-off Seed rot or decay Seedling blights	Captan, metalaxyl (Subdue), etridiazole (Truban or Terrazole), iprodione (Chipco 26019), Banrot	Apply captan as a seed treatment any time before planting. Grow plants in sterilized (pasteurized) soil wherever feasible. Mix metalaxyl+Banrot, iprodione, and etridiazole into soil or apply as drenches. Check labels for crop registrations.
Storage decay	Zineb, captan, Botran, benomyl, or Ornalin	Spray, dust, or dip plants, and other plant parts before shipping or placing in storage. Check labels for crop registrations.
Cutting rots Damping-off Seedling blights Crown (foot) rots Stem rots Root rots	PCNB (Terraclor), captan-PCNB mixtures, Banrot, benomyl (Benlate), PCNB-etridiazole (SA Terraclor Super-X), or thiophanate-methyl (Topsin-M)	For Botrytis, Rhizoctonia, Sclerotinia, and Sclerotium stem and root rots only. Apply as a soil drench at 1 pint per sq ft or work into upper 2 to 4 inches of soil before planting. Check labels for crop registrations.

Diseases	Chemicals for control	Remarks
Cutting rots Damping-off Seedling blights Crown (foot) rots Stem rots Root rots *(continued)*	Propamocarb (Banol), fosetyl-Al (Aliette), etridiazole (Truban or Terrazole), Banrot, metalaxyl (Subdue), or PCNB-etridiazole (SA Terraclor Super-X)	For Aphanomyces, Phytophthora, and Pythium stem and root rots (water molds) only. Usually applied as a soil drench at intervals of 2 to 8 weeks. Check label instructions. Sometimes combined with PCNB (Terraclor) or other fungicide.
Leaf, stem, and flower spots and blights caused by fungi	Benomyl + captan, zineb, maneb, mancozeb, ferbam, folpet (Phaltan), chlorothalonil (Daconil 2787, Exotherm Termil), Zyban, Duosan, vinclozolin (Ornalin), triforine (Funginex), iprodione (Chipco 26019), or triadimefon (Bayleton)	Benomyl plus captan, zineb, folpet, chlorothalonil, or mancozeb also gives *Botrytis* control, as does vinclozolin, Zyban, Duosan, and iprodione. Applications are needed at intervals of 5 to 7 days in rainy weather and 7 to 10 days in drier weather. Check labels for specific information and crop registrations.
Rusts	Zineb, maneb, mancozeb, ferbam, oxycarboxin (Plantvax), triadimefon (Bayleton), bitertanol (Baycor), or triforine (Funginex)	Applications usually needed at intervals of 7 to 10 days, starting when rust first appears. Check labels for current crop registrations.
Powdery mildews	Benomyl, sulfur, dinocap (Karathane), triforine (Funginex), Zyban, Duosan, triadimefon (Bayleton), cycloheximide (Acti-dione PM), or thiophanate-methyl (Topsin-M)	Frequent applications and thorough coverage are essential. Cycloheximide, sulfur, and dinocap may cause plant injury, especially in hot weather at 85°F or above. Check labels for current crop registrations.
Bacterial flower, leaf, and shoot blights	Streptomycin formulations or copper fungicide	Follow manufacturer's directions strictly to avoid plant injury. Note label restrictions.
Wilt diseases (mostly *Fusarium* and *Verticillium*) Crown and root rots Crown gall	Steam at 180°F for 30 minutes or 160°F for 1 hour or fumigate soil with methyl bromide, chloropicrin, Vorlex, or Vapam Soil Fumigant.	Treat soil several days to a month before planting. Follow manufacturer's directions as chemicals are very toxic. Some may be used only by licensed commercial applicators. Also treat containers, benches, work surfaces, potting table, tools and other equipment. Galltrol A and Norbac 84-C are crown gall controls. See label for Vydate uses.
Soil nematodes (including root-knot and root-lesion nematodes)	Same as wilt diseases (above) or apply 1,3-D (D-D) or oxamyl (Vydate).	

Diseases	Chemicals for control	Remarks
Viruses Viroids Mycoplasmas	Apply insecticides at frequent intervals to keep the insects from feeding, as recommended by University of Illinois entomologists.	Control insects that transmit the causal agents, especially leafhoppers, aphids, and thrips. Rogue the first infected plants. Keep down broadleaf weeds. Keep greenhouse and nursery beds screened.

* NOTE: For detailed information regarding specific woody ornamentals and the chemicals suggested to control their diseases, obtain a current copy of Illinois Extension Circular 1260, "Plant Disease Control Guide: Woody Ornamentals."

Fertilization

Unthrifty and undernourished woody ornamentals are susceptible to a variety of diseases and environmental stresses. Their vigor can often be greatly improved by periodic applications of fertilizer and timely watering. Soil tests are always suggested prior to feeding, especially if a soil or lawn fertilization program has been in effect. In general, a 10-10-10 (NPK) fertilizer is recommended at the rate of 2 to 4 pounds per inch of trunk diameter at breast height. The fertilizer can be injected into holes in the ground evenly distributed beneath the tree and extending out to the drip line or beyond. Alternatively, apply fertilizer by surface broadcasting about 1 or 2 pounds actual nitrogen per 1,000 square feet during the dormant season; ammonium nitrate or nitrate of soda are acceptable compounds.

Sanitation

Proper selection of planting site, planting method, and materials, as well as soil preparation, pruning, winter protection, disease and pest control, and avoidance of unnecessary wounding will aid in control of a wide range of diseases.

Prune during dry weather and sterilize tools frequently between cuts. Use a fresh 10 percent solution of liquid household bleach, 70 percent denatured alcohol, or radiator antifreeze-type alcohol or 4 percent formaldehyde. When pruning or removing diseased wood, paint the newly exposed inner bark and sapwood with a germicidal or fungicidal coating. Shellac is useful for many diseases. Follow the shellac with a tree wound paint containing benomyl (Benlate) fungicide, 50% WP, at the rate of 1 gram in 5,000 grams or 2-2/3 ounces per 100 gallons. This mixture, although harmless to living bark, is toxic to spores of such canker- and wilt-producing fungi as *Botryosphaeria*, *Ceratocystis*, *Cytospora (Valsa)*, and *Verticillium*.

Surfactants

Wetting, spreading, and sticking agents (surfactants) are often added to spray mixtures for hard-to-wet foliage such as on conifers, broadleaf evergreens, boxwood, and roses. Some commercial spreader-stickers available for tank mixing include Biofilm Spreader-Sticker, Chevron Spray Sticker, Citowett Plus, Filmfast Spreader-Sticker, Miller Nu-Film -P and -17, De-Pester Spreader-Activator, DuPont Spreader-Sticker, and Aqua T Non-ionic Organic Wetting Agent. Commercial spreaders include Chevron Spreader, Chipco and Rhodia Spreader-Activator, Flo-Wet, Multi-Film L and X-77, Ortho X-77 Spreader, Pinolene, Sure Spred, Surfactant II, Triton B-1956, Tween 20, Flexit, Sanomerse 80, and Penex. The pesticide label usually indicates any restrictions that should be observed in selecting compatible surfactants. Use these commercial preparations according to label directions. The addition of any extra wetting, spreading, or sticking agent may cause excess runoff and result in a poor spray deposit.

CHEMICAL WEED CONTROL RECOMMENDATIONS FOR LANDSCAPE PLANTINGS

Many landscape managers consider weeds to be their most common and bothersome pest problem. Weeds are ubiquitous, infesting beds of woody and herbaceous ornamental plants, turf areas, and cracks in paved areas such as sidewalks and parking lots.

Beside being unsightly and giving an unmanicured appearance to commercial and residential landscape sites, weeds compete with desirable ornamental plants for nutrients, light, and growing space. They also can harbor insect and disease pests; they can be fire hazards, and noxious weeds such as poison ivy and ragweed can be health hazards.

Weed management programs for landscape sites include methods for both the eradication and prevention of weeds. The goal of a successful weed control program should be to integrate cultural decisions, mechanical methods, and chemical methods into an efficient and effective strategy to control weeds with a minimum of labor, cost, and environmental hazard.

The remainder of this article concentrates on the chemical component of weed control in programs of landscape plantings of herbaceous and woody ornamental plants.

HERBICIDE SELECTION

Herbicides provide an efficient means for controlling weeds. They are precise in their activity, but satisfactory results can only be achieved if herbicides are used properly. The first step in selecting a herbicide is to identify your weed problem.

Herbicides are classified as selective or nonselective, depending on the range of plants they kill. Selective herbicides kill certain plants with little or no injury to others. This is of the utmost importance when applying herbicides to areas containing ornamental plants. Selective herbicides include both foliage and soil applied herbicides.

Nonselective herbicides are toxic to almost all plants. Some herbicides that are selective at a low rate may be nonselective when appplied at a high rate. Nonselective herbicides are useful in areas where total vegetation control is desired, such as in industrial areas, along fences, around buildings, and in other noncrop areas. Nonselective herbicides can be either foliage- or soil-applied.

Herbicides are also classified according to when and how they are applied to the ornamental plants or weeds. *Preplant* herbicides are applied before the ornamentals are planted. They are frequently incorporated into the soil and then referred to as preplant incorporated (PPI). *Preemergence* refers to the use of a herbicide before direct-seeded ornamental plants or weeds emerge, or before the weeds appear in landscape plantings. Most soil-applied herbicides require moisture to facilitate absorption by emerging weed seedlings. Rainfall can move the herbicide into the soil and provide the moisture for absorption. Mechanical incorporation can also move the herbicide into soil, and if sufficient soil moisture is available this can mean less dependence on rainfall. Soil texture and organic matter content affect the activity of soil-applied herbicides. The residual activity of the preemergnce herbicides can vary from several weeks to several months.

Postemergence refers to the use of herbicide after the crop or weeds have emerged. Postemergence herbicides are applied to the foliage of the weeds. Most must remain on the weed foliage for several hours to be effective. If rain falls shortly after application, retreatment may be necessary. Postemergence herbicides may be broadcast *over-the-top* if both ornamental plants and weeds if they are sufficiently selective to kill weeds without significantly affecting the ornamentals. Some less selective herbicides may be applied as *directed postemergence*, when the spray is directed onto the weeds and kept off the ornamental plants as much as possible. For directed sprays, it is helpful to have a height differential with weeds smaller than the ornamental plants. Earlier cultural practices, mechanical cultivation, or herbicides can sometimes help to establish this height differential. Spot treatments are applied to individual weeds or small patches of weeds.

Herbicides are also classified by their type of activity. *Translocated* or *systemic herbicides* move (translocate) in the plant from the site of uptake. The site of uptake can be either the roots or emerging shoots when the herbicide is applied to the soil, or the foliage and/or stem when an aboveground treatment is made. Since the plant must be actively growing for these herbicides to translocate to sites of action, most are applied during the growing season. Injury symptoms may take several days to several weeks to develop, depending on the type of herbicide. Since translocated herbicides can move throughout the plant system, they are effective against annuals, biennials, and perennials. Depending on the particular herbicide, activity may be selective or nonselective.
Nontranslocated herbicides are active at the site of absorption or contact. They do not translocate within the plant. They are either soil-applied or foliage-applied. They can be applied at various times.

Foliage-applied nontranslocated herbicides are usually called *contact* herbicides. They nonselectively kill green foliage on contact by killing the plant tissue. Since only the tissue actually may be killed, surfactants are often added to improve coverage of the foliage. Contact herbicides can be effective for the control of annual plants if all the growing points are aboveground and thoroughly sprayed. They will also burn back the aboveground portions of biennial and perennial plants, but regrowth may occur since these plants have growing points that are underground and therefore protected. The injury symptoms of a plant treated with a contact herbicide are usually visible within a matter of hours. Contact herbicides usually have little or no residual soil activity.

To ensure that the proper herbicide is chosen for the ornamental planting and the particular weed problem, always read the label. The label gives rates and directions for use as well as precautions to prevent possible harm to the applicator, other people, animals, and the environment.

The different herbicide categories are discussed in greater detail below.

PREEMERGENCE HERBICIDES

Alachlor (*Lasso*)* is available in emulsifiable concentrate and granular formulations. It is labeled for use on a limited number of woody plant species. Apply at 4 pounds active ingredient per acre (aia) for the control of annual grasses.

Bensulide (*Betasan*)* is used primarily for the control of annual grasses. Apply at a rate of 10 to 12 pounds aia and irrigate after application. Bensulide can be used in established flower beds and carpet bugle, ivy, pachysandra, and sedum groundcovers.

Chloramben (*Ornamental Weeder, Amiben, Garden Weeder, Weedone*)* is used for control of a number of annual broadleaf and grass weeds. Apply at 4 pounds aia to weed-free soil and irrigate following application. Chloramben is registered for use in established flower beds. Vegiben* is another formulation registered for several vegetable crops.

Chlorpropham (*Furloe, Chloro-IPC, CIPC*)* is available in emulsifiable and granular formulations. The granular formulation is commonly used in ornamenals. Apply at 4 pounds aia on sandy soil and 6 pounds aia on heavier soils for control of annual broadleaf and grass weeds. Chlorpropham is very effective for chickweed control, both pre- and postemergence. It has an extensive label including many species of trees, shrubs, flowers, and groundcovers.

DCPA (*Dacthal*)* is available in wettable powder and granular formulations. Apply at 10 to 12 pounds aia to a weed-free area primarily for the control of annual grasses. DCPA has a very extensive list of establishd flower species on its label. It is also labeled for use on many woody species. In areas without vegetative cover, more than one application per growing season may be necessary.

Dichlobenil (*Barrier, Casoron, Dyclomec, Norosac*)* is available in wettable powder and granular formulations. Apply at 4 to 6 pounds aia to control annual and perennial grasses and many broadleaf weeds. Use only on woody plants listed on the label. Dichlobenil is recommended for use in late fall and winter. If it is applied in warm weather, it should be incorporated into the soil or covered with mulch.

Diphenamid (*Enide*)* is recommended for annual weed control in flower beds and planting of woody ornamentals. Apply at 8 pounds aia to sandy soils and 12 pounds aia to heavy soils. Effectiveness will be increased with shallow incorporation or irrigation following application. More than one application will be necessary for season-long control.

EPTC (*Eptam*)* is available in emulsifiable concentrate and granular formulations. Apply at 5 pounds aia for control of annual weeds and suppression of certain perennial weeds such as nutsedge and quackgrass. Incorporation is necessary for good control.

Metolachlor (*Dual*)* has recently been labeled for use on a number of woody ornamental species. It will effectively control annual grasses, a number of broadleaf weeds, and nutsedge. Applications of 4 pounds aia will last for one growing season.

Napropamide (*Devrinol*)* is available in wettable powder and granular formulations. It is labeled for use in annual and perennial flower beds, groundcovers, and woody plants. Apply at 4 to 6 pounds aia for control of annual grasses and some broadleaf weeds. Incorporate to a depth of 2 inches or irrigate following application to improve control.

*Trade name

Oryzalin (*Surflan*)* can be used to control annual grasses and some broadleaf weeds in established plantings of groundcovers and woody ornamentals. It does not require incorporation, but it should be irrigated into the soil if there is no rainfall within a week or two of application.

Oxyfluorfen (*Goal*)* can be used as both a preemergence and postemergence herbicide. Its postemergence activity is limited to young broadleaf weeds. Groundsel and chickweed are controlled by this herbicide. The granular formulation is recommended for deciduous plants. Either the EC or granular formulation can be used on conifers.

Oxidiazon (*Ronstar or Scott's Pro Grow Herbicide I*)* is used in new and establishd plantings of groundcovers and woody ornamental plants. Apply at 4 pounds aia. Two applications may be needed for season-long weed control. It will control a broad spectrum of weed species.

Pronamide (*Kerb*)* should be applied in the fall at 2 pounds aia for the control of winter annuals, chickweed, and quackgrass. It is one of the only selective herbicides that control quackgrass in established landscape plantings.

Simazine (*Princep*)* is available in wettable powder and granular formulations. Spring or fall application at 2 pounds aia to weed-free, woody ornamentals will control a broad spectrum of weeds. Be careful to apply to only labeled species and at recommended rates since simazine will injure a number of ornamental species.

Trifluralin (*Treflan or Preen*)* is available in emulsifiable concentrate and granular formulations. Apply at 1 pound aia and incorporate into the soil. It is used in flower beds, groundcovers, and woody ornamental plantings. Since it needs to be incorporated it is not easy to use in thickly established plantings.

POSTEMERGENCE HERBICIDES

Dalapon (*Basfapon, Dowpon M* and others)* is used for postemergence control of annual and perennial grasses. Apply at 5 pounds aia. Dalapon will provide excellent control of cattails if applied when the plants are small.

Fluaziflop-butyl (*Fusilade 2000*)* is a grass-selective postemergence herbicide effective at controlling a wide range of grass species. It should be applied to young grasses in the 3- to 5-leaf stage.

Glyphosate (*Roundup, Kleenup*)* is a nonselective systemic postemergence herbicide. After being applied to the foliage of weeds, it is translocated into the root system and the entire plant is killed. Even though enough of thisherbicide to kill the plant will enter the tissue within hours, it may take 10 days to 2 weeks for the weed to appear completely dead. Keep this herbicide off the foliage of ornamental plants. There is no soil activity, therefore it can be applied over the root systems of herbaceous and woody ornamentals. It can be used to remove grass from around the base of mature trees since it will not injure the trees' bark. However, applicators should avoid spraying glyphosate on the foliage of suckers at the base of trees. Applicators such as rope wicks, wipers, lighting hoes, etc., have been developed for selectively placed glyphosate on weed foliage but not for the foliage of ornamental and crop plants.

Oxyfluorfen (*Goal*)* has postemergence as well as preemergence herbicide activity. It will control many broadleaf weeds when they are in the seedling stage. It will not control mature plants postemergence.

Paraquat (Ortho Paraquat QL, Gramoxone)* is a contact postemergence herbicide. It will give excellent control of annual weeds; however, perennial weeds often grow back from the root system. Apply at 0.5-1.0 pound aia.

Since the area to be treated is often less than 1 acre, Table 1 gives a conversion table for using herbicides on small areas where rate per acre is given. Rates per acre are usually given on the label.

Sethoxydim (*Poast*)* is a grass-selective postemergence herbicide labeled for a number of ornamental plants. Grasses are best controlled in the 3- to 5-leaf stage.

*Trade name

HERBACEOUS PLANTINGS

The problematic periods in plantings of annual and perennial bedding plants and groundcovers are during establishment and then during maintenance of the plantings. As many weeds as possible should be controlled prior to planting.

New bed areas are often developed in locations covered with turf that is full of perennial weeds. Spading or rototilling is not adequate to control perennial weeds. There are two approaches to controlling perennial weeds before planting. The first is to treat the perennial weeds with a systemic postemergence herbicide before preparing the soil in the bed area. The best herbicide for this is glyphosate. If the weed infestation is heavy and there is a significant perennial weed population, use two applications of glyphosate one month apart prior to planting.

Another approach to controlling perennial weeds prior to planting is to fumigate the beds. Methyl bromide, chloropicrin, metham-sodium, and Vorlex (Table 2) are fumigants available for this purpose. Methyl bromide and methyl bromide: chloropicrin combinations are most commonly used for this purpose.

After the bed is prepared, preemergence herbicides may be used either before or after planting, depending on the herbicide used. If the preemergence herbicides are used prior to planting, they should be incorporated into the upper 4 inches of soil. If the preemergnce herbicides are applied after planting, they should be incorporated into the soil and irrigated. Mulch before planting since it is easier to plant through a mulch than to place mulch on small plants.

Preemergence herbicides recommended for use in herbaceous plantings are bensulide, chloramben, chlorpropham, DCPA, diphenamid, napropamide, and trifluralin. Other herbicides may be labeled for use, but the above-mentioned compounds represent those materials with the most extensive list of herbaceous ornamental plants on their labels.

Plantings of Woody Landscape Plants

Beds of new plantings should be cleaned of weeds treated with a preemergence herbicide and mulched. This will provide weed control for one season. Future applications of preemergence herbicides can be made in the fall or spring, depending on the herbicide used and the time available. Ideally, a fall treatment for the control of winter annuals followed by a spring application to control summer annuals will give the most satisfactory results.

It should be remembered that no preemergence herbicide will control all species of weeds. A combination of two herbicides controlling different weed species will provide a broader spectrum of weed control. If two preemergence herbicides are used together, use each of them at one-half the rate recommended when they are used alone. Combinations for broad spectrum weed control are simazine + metolachlor, simazine + napropamide, simazine + surflan, simazine + DCPA, or oxidiazon + chlorpropham.

All of the postemergence herbicides mentioned above can be used with care in plantings of woody ornamentals. Glyphosate and paraquat should be kept off the foliage of landscape plants. Paraquat should also be kept off the bark of young trees. Combinations of postemergence and preemergence herbicides will control existing weeds as well as weeds that are yet to germinate.

Successful use of herbicides depends upon their proper selection and application. Weed control programs in landscape plantings are only as good as the people who plan, administer, and apply them. Remember, the key to a good weed control program is people and their willingness to keep current with the ever-changing field of herbicide technology.

*Trade name.

Table 1. Conversion Table for Use of Herbicides on Small Areas When Rate per Acre is Given

Rate of commercial formulations per acre	Approximate rate per 1,000 square feet
Liquid materials	
1 pint	3/4 tbls*
1 quart	1 1/2 tbls
2 quarts	3 tbls
1 gallon	6 tbls
Dry materials	
1 pound	2 1/4 tsps**
2 pounds	4 1/2 tsps
3 pounds	2 1/4 tbls
4 pounds	3 tbls
5 pounds	4 tbls
10 pounds	1/2 cup
100 pounds	2 1/4 pounds

* = tablespoons
** = teaspoons

Table 2. Common and Trade Names of Fumigants for Preplant Bed Preparation

Common name	Trade name
methyl bromide	Brom-O-Gas, Dowfume, Fumigant-1, Meth-O-Gas, Pestmaster, Terr-O-Gas
metham-sodium	Best Vapam Soil Fumigant, Science Vapam, Vapam, VPM
chloropicrin	Chlor-O-Pic, Pic-clor, Tri-clor, Larvacide
methylisothiocynanate + dichloropentene-dichloropropane	Vorlex, Di-Tapex
methyl bromide + chloropicrin	Dowfume MC-33, Dowfume MC-2, many more formulations

ORNAMENTAL HERBICIDE REGISTRATIONS

	(PPI)				(PRE														) (POST**						)
	EPTAM	LASSO	TREFLAN	BETASAN	CASORON	CHIPCO RONSTAR	DACTHAL	DEVRINOL	DUAL	ENIDE	FURLOE	GOAL	KERB	LASSO	OH 1	OH 2	OR. WEEDER	PRINCEP	ROUT	SURFLAN	TREFLAN	FUSILADE	GOAL	KERB	PARAQUAT	POAST	ROUNDUP
Abelia spp.				F			F	X												X						
Abelia grandiflora				F		C	F	X								X				X						
Abies spp.	F						F	X			Y		F									F	F	F	F	F
Abies balsamea	F		F				F	X			Y		F					F		F	F	F			F	F
Abies fraseri	F						F	X		S	Y	Z	F					F		F		F	Z		F	F
Acer spp.	F				F		F	F	X	F	Y											F				F
Acer ginnala	F				F	F	F	F	X	F	Y											F				F
Acer palmatum	F				F		F	F	X	F	Y											F				F
Acer plantanoides	F		F		F		F	F	X	F	Y										F	F				F
Acer rubrum	F		F		F		F	F	X	F	Y						F				F	F			F	F
Acer saccharinum	F		F		F		F	F	X	F	Y										F	F			F	F
Acer saccharum	F		F		F		F	F	X	F	Y										F	F				F
Ajuga spp.	F			F				F														F				
Ajuga reptans	F			F		F		F														F			F	
Berberis spp.	F				F	X	F		X		Y							F				F			F	
Berberis thungergii	F		F		F	X	F		X	F	Y							F	X	X	F	F			F	
Betula spp.					F		F			F	Y											F			F	
Betula nigra					F		F			F	Y											F			F	
Betula papyrifera					F	F	F			F	Y											F				
Betula pendula			F		F		F			F	Y										F	F			F	
Buxus spp.	F			F	F	C	F	X	X		Y					X						F				F
Buxus microphylla	F		F	F	F	C	F	X	X		Y				X	X			X	X	F	F				F
Buxux sempervirens			F	F	F	C	F	X	X		Y				X	X				X	F	F			F	F
Carya spp. (Hickory)					F												F									
Carya illinoiensis					F			F		F															F	
Castanea spp.							F																			
Castanea mollissima			F				F														F					
Cedrus spp.								X			Y															
Cedrus deodora								X																		
Cercis canadensis			F				F			F											F	F				
Chaenomeles japonica					F																	F				
Chamaecyparis spp.	F																			X						
Chamaecyparis obtusa	F															X				X						
Chamaecyparis thyoides	F									F										X						
Cornus spp.	F	F			F		F				Y			F		X	F	F				F			F	
Cornus florida	F	F	F		F	F	F			F	Y			F		X	F	F				F			F	
Cornus sericea (C.stolonifera)	F	F			F	X	F		X		Y			F		X	F	F				F			F	
Cortaderia selloana																										
Cotoneaster spp.		F			F	X	F		X	F	Y						F	F				F			F	
Cotoneaster apiculata		F	F		F	X	F		X	F	Y				X	X	F	F		X	F	F			F	
Cotoneaster dammeri		F			F	X	F		X	F	Y						F	F	X	X		F			F	
Cotoneaster horizontalis		F			F	X	F		X	F	Y						F	F		X		F				
Cotoneaster microphyllus		F			F	X	F		X	F	Y						F	F		X		F				
Cotoneaster zabelii		F	F		F	X	F		X	F	Y						F	F				F				
Crataegus spp.							F	F													F					
Deutzia spp.			F		F		F														F					
Elaeagnus spp.					F		F			F	F							F								
Elaeagnus angustifolia					F	F	F			F								F							F	
Elaeagnus pungens			F		F		F			F								F			F					
Euonymus spp.	F	F			F	X	F	X	X	F	Y			F		X	F					F			F	F
Euonymus alatus	F	F			F	X	F	X	X	F	Y			F			F		X	X	F	F			F	F
Euonymus fortunei	F	F	F		F	X	F	X	X	F	Y			F	X	X	F		X	X	F	F				F
Fagus grandifolia										F												F				
Forsythia spp.			F		F	X	F		X	F	Y		F								F	F		F	F	
Forsythia intermedia			F		F	X	F		X	F	Y		F			X				X	F	F		F		
Fraxinus spp.					F		F	F														F				

ORNAMENTAL HERBICIDE REGISTRATIONS (continued)

	(PPI		)(PRE																		)(POST**					
	EPTAM	LASSO	TREFLAN	BETASAN	CASORON	CHIPCO RONSTAR	DACTHAL	DEVRINOL	DUAL	ENIDE	FUROLE	GOAL	KERB	LASSO	OH 1	OH 2	OR. WEEDER	PRINCEP	ROUT	SURFLAN	TREFLAN	FUSILADE	GOAL	KERB	PARAQUAT	POAST	ROUNDUP
Fraxinus americana			F		F		F	F		F							F				F	F			F	F	
Fraxinus pennsylvanica					F		F	F														F			F	F	
Ginkgo biloba						C														X							
Gleditsia triacanthos			F		F		F	F			Y							F			F				F		
Hedera helix	F		F	F	F	X	F	X	X	F	Y						F			X		F			F		
Hibiscus syriacus								F		F									X	X							
Hosta spp.																											
Hydrangea spp.							F			F	Y					X											
Hypericum spp.	F		F	F				F		F									X	X							
Iberis sempervirens				F			F												X								
Ilex spp.		X		F			F	X		F	Y		F		X		F	F				F		F			F
Ilex aquifolium		X		F	F	X	F	X		F	Y		F				F	F		F		F		F			F
Ilex cornuta		X		F	F	X	F	X		F	Y		F		X	X	F	F	X	X	F	F		F		F	F
Ilex crenata	F	X	F	F		X	F	X	X	F	Y		F		X	X	F	F		X		F		F		F	F
Ilex glabra		X		F	F		F	X		F	Y		F				F	F				F		F			F
Ilex opaca	F	X		F	F		F	X	X	F	Y		F		X		F	F				F		F			F
Juglans spp.							F	F																	F		
Juglans nigra			F				F	F		Z								F			F			F	F		
Juniperus spp.	F	X		F	F		F	X		F	Y		F	X			F	F		X		F	C	F		F	
Juniperus chinensis	F	X	F	F	F	X	F	X		F	Y	C	F	X	X	X	F	F	X	X	F	F	C	F		F	
Juniperus conferta	F	X	F	F	F	C	F	X	X	F	Y		F	X			F	F	X	X	F	F		F		F	
Juniperus horizontalis	F	X		F	F	X	F	X	X	F	Y	C	F	X	X	X	F	F	X	X		F	C	F		F	
Juniperus procumbens	F	X		F	F	C	F	X	X	F	Y		F	X			F	F		X		F		F			
Juniperus virginiana	F	X	F	F	F		F	X		F	Y		F	X			F	F		X	F	F		F		F	
Kalmia spp.							F		X	F	Y																
Kalmia latifolia			F		F		F		X		Y									X	F						
Koelreuteria paniculata					F	F																					
Kolkwitzia amabilis						F				F																	
Lagerstroemia indica				F		C													X	X		F					
Leucothoe spp.	F				F	C			X		Y																
Leucothoe axillaris	F					C			X		Y									X							
Ligustrum spp.				F	F		F	X	X	F	Y											F			F		F
Ligustrum ovalifolium			F	F	F	X	F	X	X	F	Y										F	F					F
Liquidambar styraciflua			F				F			F										X	F	F				F	
Liorodendron tulipifera			F		F		F			F	Y										F	F				F	
Liriope spp.			F					X												X		F				F	
Lonicera spp.(Xylosema)			F	F	F	X	F		X	F	Y					X				X	F						
Lonicera fragrantissima			F	F	F	X	F		X	F	Y							F		X							
Magnolia spp.	F				F		F				Y						F					F					F
Magnolia grandiflora	F				F	C	F				Y						F			X						F	F
Mahonia spp.										F	Y							F		X							
Malus spp.		F	F		F			F	X	F										F	F	F			F	F	F
Malus floribunda		F	F		F	F	F	F	X	F	Y			F						F		F			F	F	F
Malus pumila		F	F		F			F	X	F								F		F		F			F		F
Nyssa sylvatica			F																		F						
Osmanthus spp.					F	C			X																		
Osmanthus heterophyllus									X											X							
Pachysandra terminalis	F			F			F	F	X		Y															F	
Parthenocissus tricuspidata							F																			F	
Philadelphus spp.			F		F		F			F	Y										F						
Picea spp.	F						F	F			Y											F					F
Picea abies	F		F			F	F	F		S	Y	W						F	X	F	F	F	W			F	F
Picea glauca	F		F				F	F		S	Y				X			F	X	F	F	F				F	F
Picea pungens	F		F				F	F			Y	W			X			F		X	F	F	W			F	F
Pieris spp.	F					C	F		X		Y						F	F									
Pinus spp.	F						F	X			Y		F				F					F		F	F		F
Pinus mugo	F						F	X			Y	C	F		X		F	F	X	X		F	C	F	F	F	F

ORNAMENTAL HERBICIDE REGISTRATIONS (continued)

	(PPI)(					PRE												)(POST**)						
	EPTAM	LASSO	TREFLAN	BETASAN	CASORON	CHIPCO RONSTAR	DACTHAL	DEVRINOL	DUAL	ENIDE	FURLOE	GOAL	KERB	LASSO	OH 1	OH 2	OR. WEEDER	PRINCEP	ROUT	SURFLAN	TREFLAN	FUSILADE	GOAL	KERB	PARAQUAT	POAST	ROUNDUP
Pinus nigra	F		F			X	F	X		S	Y	C	F				F			F	F	F	C	F	F	F	F
Pinus resinosa	F		F			F	F	X			Y		F				F	F				F		F	F		F
Pinus strobus	F		F			F	F	X		S	Y	W	F				F	F	X	X	F	F	W	F	F	F	F
Pinus sylvestris	F		F			X	F	X		S	Y	C	F				F	F		F	F	F	C	F	F	F	F
Pinus thunbergii	F		F			X	F	X			Y		F			X	F		X	X	F	F		F	F	F	F
Pinus virginiana	F						F	X			Y	W	F		X	X	F				F	F	W	F	F	F	F
Platanus spp.							F				Y																
Platanus acerifolia		F	F				F				Y										F						
Platanus occidentalis			F				F			F	Y										F				F		
Platycladus orientalis (Thuja)							F		X			C			X		F	F		X		F	C				
Populus spp.					F		F	F			Y																
Populus deltoides			F		F		F	F		F	Y										F						
Prunus spp.(peach & cherry)			F					F		F	Y				F						F	F			F	F	
Prunus spp.(plum)			F					F		F	Y									F		F			F	F	
Prunus caroliniana			F					F		F	Y									F	F	F			F		
Prunus cerasifera								F		F	Y									F		F			F		
Prunus laurocerasus					F			F		F	Y									F		F			F		
Prunus persica								F		F										F		F			F		
Prunus sargentii								F		F	Y									F		F			F		
Prunus serrulata								F		F	Y									F		F			F		
Prunus subhirtella pendulata								F		F	Y									F		F			F		
Prunus yedoensis								F		F	Y									F		F			F		
Pseudotsuga menziesii/ taxifolia			F				F	X		S	Y	Z	F					F		F	F	F	Z	F		F	F
Pyracantha spp.			F	F	F	C		X	X	F										X	F	F					
Pyracantha coccinea				F	F	C		X	X	F						X				X		F					
Pyrus spp.(pear)					F			F		F										F		F			F		
Pyrus calleryana 'Bradford'					F			F												F		F					
Quercus spp.	F				F	C	F			F						X						F			F	F	F
Quercus alba	F				F	C	F			F												F			F		F
Quercus coccinea	F		F		F	C	F			F											F	F			F		F
Quercus palustris	F		F			C	F			F											F	F			F		F
Quercus phellos	F					C	F			F												F			F	F	F
Quercus rubra	F		F			X	F			F							F	F			F	F			F		F
Rhododendron spp. (azalea)				F			F	X		F	Y		F			X	F	X		X		F		F		F	F
Rhododendron spp. (rhodo.)	F				F		F	X	X	F	Y		F		X	X	F			X		F		F		F	F
Rhododendron,Azalea hybrids-Exbury, Satsuki, Glen Dale				F			F	X		F	Y		F			X	F		X	X		F		F			F
Rhododendron indica			F	F		X	F	X		F	Y		F			X	F			X	F	F		F		F	F
Rhododendron molle				F	F		F	X		F	Y		F			X	F			X		F		F		F	F
Rhododendron obtusum			F	F	F	X	F	X		F	Y		F		X	X	F		X	X	F	F		F		F	F
Rosa spp.	F		F		F	X	F	X	X	Z	Y									X	F						
Salix spp.			F		F		F			F											F	F			F		
Sedum spp.	F			F		F	F													X							
Spiraea spp.					F		F		X	F	Y				X	X	F					F			F		
Spiraea vanhouttei			F		F		F		X	F	Y				X	X	F				F	F			F		
Syringa spp.	F				F		F				Y																F
Syringa persica	F				F	F	F				Y																F
Syringa vulgaris	F		F		F		F			F	Y									X	F						F
Taxodium distichum			F							Z											F						

ORNAMENTAL HERBICIDE REGISTRATIONS (continued)

	(PPI		)(PRE																)(POST**				
	EPTAM	LASSO	TREFLAN	BETASAN	CASORON	CHIPCO RONSTAR	DACTHAL	DEVRINOL	DUAL	ENIDE	FURLOE	GOAL	KERB	LASSO	OH 1	OH 2	OR. WEEDER	PRINCEP	ROUT	SURFLAN	TREFLAN	FUSILADE	GOAL	KERB	PARAQUAT	POAST	ROUNDUP
Taxus spp.	F	F			F		F	F	X		Y	C	F	F		X	F	F				F	C	F			F
Taxus canadensis	F	F			F		F	F	X	F	Y	C	F				F	F				F	C				F
Taxus cuspidata	F	F	F		F		F	F	X		Y	C	F			X	F	F		X	F	F	C			F	F
Taxus media	F	F	F		F	F	F	F	X		Y	C	F				F	F			F	F	C				F
Thuja spp.					F	C	F	C	X		Y	C				X	F	F		X		F	C		F		F
Thuja occidentalis			F		F	F	F	C	X	Z	Y	C				X	F	F	X			F	C		F	F	F
Tilia spp.	F				F																					F	
Tsuga spp.	F							F			Y						F	F				F					F
Tsuga canadensis	F		F			F		F		Z	Y	S					F	F			F	F	S			F	F
Tsuga caroliniana	F							F			Y						F	F				F					F
Ulmus spp.					F		F											F				F		F		
Ulmus americana					F		F											F				F		F		
Vaccinium spp.										F																
Viburnum spp.	F					X	F		X	F	Y					X	F		X			F				
Viburnum suspensum	F		F			X	F		X	F	Y						F			X	F	F					
Viburnum trilobum																								F		
Viburnum wrightii	F		F			X	F		X	F	Y						F				F	F					
Vinca spp.	F		F	F				F	X	F																	
Vinca minor	F		F	F		X		F	X	F	Y									X		F				F	
Weigela spp.			F		F		F		X	F									X	X	F						
Wisteria spp.																											
Yucca spp.																											
Yucca filamentosa															X												
Zelkova serrata																											

** Many chemicals are labeled for directed applications only; check labels for specific restrictions.

KEY TO WEED CONTROL:
F=field
D=dormant stock only
Y=field-dormant stock
W=field + container + seedbed
C=container
S=seedbed
X=field + container
Z=field + seedbed

INSECT PEST MANAGEMENT RECOMMENDATIONS

FOR TREE AND SHRUB INSECTS

Insect	Insecticide	Lb. of active ingredient per 100 gal. of water	Timing of application[a]
Aphids (NHE-47)	acephate 75% S	1/2	When aphids are numerous. Spray with high pressure and thoroughly cover the foliage.
	malathion 50-57%E, 25W	1	
	diazinon 4E, 4E, 25%E, 50W	1	
Ash borer (NHE-145)	chlorpyrifos 2E, 4E, 50W	1	Apply in early June and repeat 4 weeks later.
	acephate 75%S	1/2	
Bagworm (NHE-16)	malathion 50-57%E, 25W	1	Spray foliage thoroughly about June 15 while worms are still small and before extensive feeding has occurred.
	carbaryl 80%S, 50W	1	
	chlorpyrifos 2E, 4E, 50W,	1/2	
	Bacillus thuringiensis	follow label directions	
	acephate 75%S	1/2	
Birch leaf miner	acephate 75%S	1 1/3	Spray foliage thoroughly when miners first appear. Repeat 10 to 12 days later.
	malathion 50-57%E, 25W	1	
	diazinon 4E, 25%E, 50W	1	
	dimethoate 2E, 25W	1/4	
	chlorpyrifos 2E, 4E, 50W	1	
Black vine weevil	acephate 75%S	1	Spray foliage thoroughly in mid-May when adults are on foliage. Allow spray to run off onto soil under shrubs. Repeat twice at two-week intervals.
	bendiocarb 76W	1 1/4	
Bronze birch borer (NHE-143)	dimethoate 2E	1/2	Spray bark of trunk and limbs in late May and repeat 3 weeks later.

[a]Treatment dates are listed for central Illinois. In southern Illinois apply 2 weeks earlier and in northern Illinois 2 weeks later.

Insect	Insecticide	Lb. of active ingredient per 100 gal. of water	Timing of application[a]
Cankerworm (NHE-95)	acephate 75%S	1/2	Spray when worms are still small as leaf buds are opening in spring.
	malathion 50-57%E, 25W	1	
	diazinon 4E, 25%E, 50W	1	
	carbaryl 80%S, 50W	1	
	Bacillus thuringiensis	follow label directions	
Cicada (NHE-113)	carbaryl 80%S, 50W	1	Spray foliage when egglaying begins. Repeat every 5 days while adult cicadas are present.
Cooley spruce gall aphid (NHE-80, 81)	malathion 50-57%E, 25W	1	Apply in late September or in early spring just before buds swell.
	diazinon 4E, 25%E,50W	1	
Cottony maple scale (NHE-144)	acephate 75%S	2/3	Spray in July after crawlers have hatched and are active and repeat 10 days later.
	malathion 50-57%E		
	diazinon 4E, 25%E, 50W	1	
	superior oil	2 gallons	Apply in spring before leaf emergence. Do not use on Japanese or sugar maple.
Dogwood borer	chlorpyrifos 2E, 4E, 50W	1	Apply in mid-May and repeat 4 weeks later.
Eastern spruce gall aphid (NHE-80, 81)	malathion 50-57%E, 25W	1	Apply in late September or in early spring just before the buds swell.
	diazinon 4E, 25%E, 50W	1	
	chlorphyrifos 2E, 4E, 50W	1	
Eastern tent caterpillar	acephate 75%S	1/2	Spray areas of tree where nests first appear in early spring. Remove small nests from trees or prune out webs and destroy them.
	malathion 50-57%E, 25W	1	
	diazinon 4E, 25%E, 50W	1	
	Bacillus thuringiensis	follow label directions	
	chlorpyrifos 2E, 4E, 50W	1	
Elm bark beetles	methoxychlor		Contact Section of Applied Botany and Plant Pathology, Illinois Natural History Survey, Urbana, Illinois 61801, for information on Dutch elm disease control.

Insect	Insecticide	Lb. of active ingredient per 100 gal. of water	Timing of application[a]
Elm cockscomb gall (NHE-80, 81)	diazinon 4E, 25%E, 50W	1	Usually no control is necessary.
	malathion 50-57%E, 50W	1	
Elm leaf beetle (NHE-82)	carbaryl 80%S, 50W	1	Apply when damage first appears, usually late May and again in late July-early August.
	acephate75%S	1/2	
	diazinon 4E, 25%E, 50W	1	
Euonymous scale (NHE-100, 114, 146)	acephate 75%S	2/3	Spray in early June when crawlers are active. Make four applications 10 to 12 days apart.
	dimethoate 2E, 25W	1	
	malathion 25W, 50-57%E	1	
	diazinon 4E, 25%E, 50W	1	
European elm scale (NHE-100, 114, 146)	malathion 25W, 50-57%E	1	Apply in early spring when first leaves appear.
European pine sawfly	carbaryl 80%S, 50W	1	Spray when worms are small and feeding on the needles.
	chlorpyrifos 2E, 4E, 50W	1	
	diazinon 4E, 25%E, 50W	1	
European pine shoot moth (NHE-83)	dimethoate 2E	1	Spray ends of branches thoroughly in late June before larvae enter the growing shoot. Aerial = 1 qt/ac. in 4 gal. of water. Ground = 1 qt/ac. in 100 gal. of water.
Fall webworm	acephate 75%S	1/2	Spray nests or webbed areas in trees in late summer. Do not apply acephate to crabapple. If webs are small, prune out and destroy.
	carbaryl 80%S, 50W	1	
	malathion 50-57%E, 25W	1	
	diazinon 4E, 25%E, 50W	1	
	Bacillus thuringiensis	follow label directions	
	chlorpyrifos 2E, 4E, 50W	1	
Flat-headed apple tree borer	dimethoate 2E	1/2	Spray in late May and repeat twice at 3-week intervals. Keep trees in vigorous growing condition. Wrap trunks of new set trees with paper or burlap.

Insect	Insecticide	Lb. of active ingredient per 100 gal. of water	Timing of application[a]
Fletcher scale (NHE-100, 114, 146)	malathion 25W, 50-57%EC	1	Apply in early April and repeat in early June.
Forest tent caterpillar	acephate 75%S	1/3	Spray when caterpillars are small.
	carbaryl 80%S, 50W	1	
	malathion 25W, 50-57%E	1	
	diazinon 4E, 25%E, 50W	1	
Gouty oak gall	...	...	Prune out infested branches and destroy.
Hackberry psyllids	malathion 25W, 50-57%E	1	Apply in late May. This insect rarely damages trees. Control is usually not necessary.
	diazinon 4E, 25%E, 50W	1	
Hawthorn leaf miner	acephate 75%S	2/3	Treat in early May or when first sign of leaf-browning appears.
	malathion 50-57%E, 25W	1	
	diazinon 4E, 25%E, 50W	1	
Hawthorn mealy bug	malathion 50-57%E, 25W	1	Apply when insects are numerous.
	diazinon 4E, 25%E, 50W	1	
	dimethoate 2E, 25W	1/2	
Holly leaf miner	dimethoate 2E, 25W	1/2	Spray foliage in late May or early June when leaf miners first appear.
	acephate 75%S	1/2	
Honeysuckle aphid	acephate 75%S	1/2	Spray at first sign of damage. Repeat 4 weeks later.
	dimethoate 2E	1/2	
	oxydemeton-methyl 25%E	3/4	
Lacebug	acephate 75%S	1/2	Spray when bugs are numerous.
	carbaryl 80%S, 50W	1	
	malathion 25W, 50-57%E,	1	
Leaf crumpler	malathion 25W, 50-57%E	1	Spray in late May and again in late August.
	diazinon 4E, 25%E, 50W	1	
Leafhoppers	carbaryl 50W, 80%S	1	Spray when hoppers are numerous on foliage. Permethrin is for use on nursery stock only.
	permethrin 3.2 E	0.1-0.2	

Insect	Insecticide	Lb. of active ingredient per 100 gal. of water	Timing of application[a]
Lecanium scale (NHE-146)	acephate 75%S	2/3	Apply to infested trees in mid-June when crawlers are active and repeat 2 weeks later.
	diazinon 4E, 25%E, 50W	1	
	malathion 25W, 50-57%E	1	
Lilac borer (NHE-145)	chlorpyrifos 2E, 4E, 50W	1	Apply in mid-May and repeat 4 weeks later.
Locust borer	carbaryl 80%S, 50W	1	Apply in late August and again in mid-September.
	chlorpyrifos 2E, 4E, 50W	1	
Locust mite	fenbutatin-oxide, 50W	1/2	Apply in early spring just before leaves appear. Repeat spray 2 weeks later.
Magnolia scale (NHE-100, 114, 146)	malathion 25W, 50-57%E	1	Treat in late September or early spring when buds are opening.
	diazinon 4E, 25%E, 50W	1	
Maple bladder gall mite (NHE-80, 81)			No effective control available.
Mimosa webworm (NHE-109)	acephate 75%S	1/2	Spray in early July or when webs first appear. Repeat in early August for second generation.
	malathion 25W, 50-57%E	1	
	diazinon 4E, 25%E, 50W	1	
	Bacillus thuringiensis	follow label directions	
	carbaryl 80%S, 50W	1	
	chlorpyrifos 2E, 4E, 50W	1	
Mountain ash borer	chlorpyrifos 2E, 4E, 50W	1	Treat in early June and repeat 4 weeks later.
Nantucket pine tip moth (NHE-83)	acephate75%S	1/2	Spray ends of branches in mid-April and late June before the larvae enter the growing shoot.
	dimethoate 2E	1	
Oak kermes	malathion 25W, 50-57%E	1	Apply in early July when crawlers appear on foliage.
	diazinon 4E, 25%E, 50W	1	
Obscure scale (NHE-100, 114, 146)	superior oil	2 gallons	Apply in late October or in early spring just prior to leaf emergence. Apply in early to mid July when crawlers are active.
	malathion 25W, 50-57%E	1	
	chlorpyrifos 2E, 4E, 50W	1	

Insect	Insecticide	Lb. of active ingredient per 100 gal. of water	Timing of application[a]
Oystershell scale (NHE-100, 114, 146)	malathion 25W,50-57%E	1	Apply in early June when crawlers are active and repeat 10 to 12 days later. Repeat sprays again in early August in central and southern Illinois.
	dimethoate 2E, 25W	1/2	
	chlorpyrifos 2E, 4E, 50W	1	
Peach tree borer (NHE-112)	chlorpyrifos 2E, 4E, 50W	1	Thoroughly spray the bark of trunk and limbs in mid-June and repeat 4 weeks later. Keep trees vigorous and avoid wounds or mechanical injury of the trunk and upper branches.
Periodical cicada (NHE-113)	carbaryl 80%S, 50W	1	Spray in June when adults are laying eggs.
Pine bark aphid	malathion 25W, 50-57%E	1	Spray when aphids are present, usually in May and later. Add spreader.
	diazinon 4E, 25%E, 50W	1	
	acephate 75%S	1/3	
Pine needle scale (NHE-100, 114, 146)	acephate 75%S	1/2	Apply spray in late May when crawlers are active if trees are infested.
	malathion 25W, 50-57%E	1	
	diazinon 4E, 25%E, 50W	1	
	chlorpyrifos 2E, 4E, 50W	1	
San Jose scale (NHE-100, 114, 146)	superior oil	2 gallons	Apply to bark of trunk and limbs in spring prior to leaf emergence.
Spider mites (NHE-58)	fenbutatin-oxide 50W	1/2	Spray when mites are numerous. Especially serious on juniper. Concentrate spray on the undersides of the foliage.
Spruce spider mite	dimethoate 2E	1/2	Spray when mites are numerous Thorough coverage of foliage is important.
Spittle bug (NHE-7)			No chemical control is necessary.
Taxus mealy bug (NHE-7)	acephate 75%S	1/2	Spray foliage with force when insects are present. Repeat 2 weeks later.
	malathion 25W, 50-57%E	1	
	diazinon 4E, 25%E, 50W	1	

Insect	Insecticide	Lb. of active ingredient per 100 gal. of water	Timing of application[a]
Thrips	malathion 25W, 50-57%E	1	Spray privet when thrips are numerous.
	acephate 75%S	1/2	
Tuliptree scale	superior oil	2 gallons	Apply oil in late spring before leaves emerge. Apply malathion in mid-August.
	malathion 75%S, 25W, 50-57%E	1	
Twig pruner			No known chemical control.
White-marked tussock moth	malathion 25W, 50-57%E	1	Treat in June when worms are small.
	carbaryl 80%S, 50W	1	
	diazinon 4E, 25%E, 50W	1	
Yellow-necked	malathion 50-57%E, 25W	1	Spray foliage when caterpillars are small, usually in late July.
	diazinon 4E, 25%E, 50W	1	
	acephate 75%S	1/2	
	chlorpyrifos 2E, 4E, 50W	1	
Zimmerman pine	dimethoate 2E, 25W	1	Spray bark and foliage either in April for control of larvae or mid-August for control of adults and eggs.
	chlorpyrifos 2E, 4E, 50W	1	

INSECTICIDE NAMES

Common name	Trade names	Common name	Trade names
acephate[a]	Orthene	fenbutatin-oxide	Vendex
Bacillus thuringiensis	Dipel, Thuricide	malathion[e]	Cythion
bendiocarb	Turcam, Dicarb	oxydemeton-methyl	Metasystox-R
carbaryl[b]	Sevin	permethrin	Pounce,Ambush
chlorpyrifos	Dursban	superior oil[f]	many brands
diazinon[c]	Spectracide, diazinon		
dimethoate[d]	Cygon, De-Fend		

[a]Do not use on sugar or Japanese maple, American elm, flowering crab, redbud, cottonwood, or Lombardy poplar.
[b]Do not use on Boston ivy.
[c]Do not use on ferns or hibiscus.
[d]Do not use on chrysanthemums.
[e]Do not use on canaert red cedar.
[f]Do not use on conifers, ferns, sugar maple, or Japanese maple.